Dr. Williams in connection with the patent have been doing a great and unwarranted injustice to a high-principled man, whose character and whose long and disinterested devotion to science should have made it unnecessary to break the silence he has long maintained, as I now do, without his knowledge, to right a wrong; and, as I sincerely hope, to remove completely any ground for misgiving on the part of any one of his many distinguished friends toward a loyal and worthy colleague.

ROGER H. WILLIAMS

SCIENTIFIC BOOKS

Heredity and Eugenics. A course of lectures summarizing recent advances in knowledge in variation, heredity and evolution and its relation to plant, animal and human improvement and welfare. By WILLIAM ERNEST CASTLE, JOHN MERLE COULTER, CHARLES BENEDICT DAVENPORT, EDWARD MURRAY EAST, WILLIAM LAWRENCE TOWER. The University of Chicago Press. Chicago, 1912. Pp. viii + 315. $2.50 net, $2.70 postage paid.

In view of the great leap which the study of genetics has taken in the past decade, and the notable contributions which are made almost daily, both in facts and in theories, it is hardly surprising that general systematic texts in the subject are not forthcoming at this time. Instead we have treatises of special phases of the subject, such as Mendelism or eugenics, and the publication of lectures, which are usually general summaries of more or less wide scope, attempting to keep abreast the times. Such a series of lectures delivered at the University of Chicago in the summer of 1911 is now presented to the public in book form. Considering the fact that "the lectures were given by five lecturers, with no opportunity to relate the lectures to one another other than as suggested by the assigned titles," the book, as a whole, presents a rather surprising unity, though somewhat lacking in balance and by no means covering uniformly the range of the subtitle. This, however, could not be expected under the circumstances, and the explanation in the preface disarms this criticism.

We are told that these lectures "were not intended for those trained in biology, but for a general university audience, interested in the progress of genetics as a matter of information rather than of study. The lecturers, therefore, did not address themselves to their colleagues. . . ." One familiar, however, with the "general university audience" not trained in biology, and with the difficulty the average student has in absorbing a working knowledge of such phenomena as dihybridism and multiple factors, is inclined to suspect that unless the lectures were supplemented with "asides" which are not included in the text, the "colleague," or at least the person who had made some previous study of the subject, carried more away from them than the person without preparatory biological training. It is safe to say that the comparatively small amount of repetition which occurs will prove no detriment to the general reader.

Professor Coulter undertakes the rather thankless task of paving the way for the real procession, which is to follow. In the first two chapters, dealing with "Recent Developments in Heredity and Evolution: General Introduction" and "The Physical Basis of Heredity and Evolution from the Cytological Standpoint," he has done this in an orthodox, but on the whole very clear and interesting, manner. The relation of the processes of inheritance to evolution, plant and animal breeding, and to eugenics, is pointed out and a cytological basis supplied upon which the Mendelist may hang his interpretations without compunction. Coulter, unlike many cytologists at the present time, evinces no hesitancy in placing upon the chromosomes the burden of hereditary transmission (p. 32).

In the third and fourth chapters Professor Castle treats of "The Method of Evolution" and "Heredity and Sex." These chapters are very similar to parts of the same author's recent book,[1] which is itself a series of lectures

[1] "Heredity in Relation to Evolution and Animal Breeding." D. Appleton & Co., New York, 1911.

rather than a text; but perhaps nowhere has he stated more clearly his position with respect to the methods of evolution. In this, as rather opposed to the present tendency, he stands with Darwin in his belief that the selection of small fluctuating variations has been a more potent factor in evolution than distinct genetic mutations. In other words, he believes in the changeability or modifiability of "unit-characters"—we wonder if it is with intent aforethought that he does not say "unit-factors"? From a purely logical standpoint, however, it is difficult to see why those cases which Castle adduces in support of the changeability idea—the polydactylous race of guinea pigs and the color-pattern series in rats (pp. 56–61)—are not capable of the same explanation as the size of the maize ear (pp. 54–56), in which case Castle accepts East's explanation of a number of independent factors. Castle states his position succinctly in the last paragraph of Chapter III. (p. 61), which is accordingly worth quoting in full:

"Accordingly we conclude that unit-characters are not unchangeable. They can be modified, and these modifications come about in more than a single way. Occasionally a unit-character is lost altogether or profoundly modified at a single step. This is mutation. But more frequent and more important, probably, are slight, scarcely noticeable modifications of unit-characters that afford a basis for a slow alteration of the race by selection. Mutation, then, is true, but it is a half-truth; selection is the other and equally important half of the truth of evolution, as Darwin saw it and as we see it."

Leaving aside the restricted use of "selection" in the above paragraph—for the strictest mutationist could scarcely dispense with selection as an operative force in evolution—interest centers on the question of the modifiability of unit-characters. In Chapter V., "Inheritance in the Higher Plants," Professor East takes up this point, and maintains that the instability of unit-characters does not affect "the truth of the genotype conception as a help toward an idea of the process of heredity." If Castle means by "unit-characters" the "personal qualities" of Johannsen, it would seem that East has justification in his opinion that their views are not incompatible.

One hears much criticism of Mendelists on the ground that they are too ready to think of "factors" as material things, to regard genetic formulæ as representing actualities, and to juggle with increasingly complicated theories which have no secure foundation. While it is true of all theorizing that there is danger in the joy of construction of forgetting flaws in the basic premises, this is really a criticism of individual method. Every worker should make his own reservations, however much he may try to fit his facts to this or that theory. East, who is perhaps as dyed-in-the-wool a Mendelist as there is in this country, shows commendable caution when he sums up the essentials of Mendelism in the following words (pp. 89, 90):

"Stated in fewer words, the essential feature of Mendelianism is the segregation of potential characters in the gamete in a state of apparent purity, and their recombination by the law of chance through random mating. The term 'Mendelian notation' was therefore used advisedly. Mendelian notation is a simple *interpretation* of certain *facts* of heredity *obtained in pedigree cultures.* It is a convenient notation and is used much as the element symbols are used in chemistry. *It makes no difference to analytical chemistry whether or not an atom is a reality, for the law of 'Definite and Multiple Proportions' upon which analytical chemistry is based is still valid.* In the same way it makes no difference whether one regards unit-characters as actual units and their segregation as complete, or whether one sees in organisms a mutual dependence between characters and a quantitative or partial segregation among gametic factors, the notation is useful either way to make clear the facts of heredity as shown by actual experiment."[2]

Chapter V., from which quotation has just

[2] Italics not in original.

been made, reviews the facts of Mendelism, using plant subjects as illustrations, and introduces some of the more complicated cases. In his second chapter, which considers "The Application of Biological Principles to Plant Breeding," East treats the subject in much the way he did in his earlier valuable bulletin.[3] Perhaps most interesting in the chapter is his discussion and presentation of the evidence for the stimulating effect of crossing.

By far the longest chapter is the sixth (more than a third of the whole book), by Professor Tower, on "Recent Advances and the Present State of Knowledge Concerning the Modification of the Germinal Constitution of Organisms by Experimental Processes." One feels that for general, and professedly non-technical, purposes this chapter would have been improved by the omission of much of the detail of the author's own experiments and a clear statement of the results. Certainly in its present form it does not hold the interest of the reader to an equal degree with the other chapters, and it is difficult to see how a non-biological audience can have followed the detail in the lectures. Tower sums up the evidence to prove that the "impinging of incident forces" upon the germ plasm may modify the germinal constitution of organisms, but combats "the hypothesis of the peripheral origin and transmission of variations," otherwise spoken of in common parlance as "the inheritance of acquired characters." Tower apparently does not, however, consider the fact of possible direct modification of the germinal constitution inimical to Mendelian interpretation.

Chapters VIII. and IX., by Dr. Davenport, contain much of the interesting material given in his recent book on eugenics.[4] The former, entitled "The Inheritance of Physical and Mental Traits of Man and their Application to Eugenics," is largely a catalogue of the method of inheritance of various traits in man, accompanied by family charts by way of illustration. In the second of his chapters are discussed, with concrete examples, the effects of segregation and migration and their eugenic significance, followed by the inevitable "Edwardses" and "Jukes" as examples of the descent of good and bad single lines of germ plasm.

There is little need to call attention to minor inaccuracies in a book of this nature, which really are few. The typography and proof-reading are good. On pages 124 and 125 there was noticed some confusion in referring to figures 53 and 54.

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A Handbook of Sugar Analysis. A Practical and Descriptive Treatise for Use in Research, Technical and Control Laboratories. By C. A. Browne, Ph.D., chemist in charge of the New York Sugar Trade Laboratory. New York, John Wiley and Sons. 1912. Cloth, $6.00 net. Sugar tables separate, cloth, $1.25.

Dr. Browne's volume is the latest and certainly one of the most noteworthy publications by which the literature of the sugar-industry has been enriched within the past decade.

The author presents not only a very full selection of the most approved methods of sugar analysis, but offers—as he is most eminently qualified to do—account of the applicability and limitations of the various methods discussed.

On this account the work is of value not only to the chemist who is entrusted with the supervision and control of the laboratory of a working plant, and who, above all things, seeks to place his finger on the most accurate and practical methods of analysis, but also to the student and worker who desires to understand thoroughly the principles and theory underlying such methods.

The volume is divided into two parts. The first part is given over to a consideration of physical and chemical methods of sugar analy-

[3] "The Relation of Certain Biological Principles to Plant Breeding." By Edward M. East, Ph.D. Conn. Agr. Expt. Sta., Bull. 158, 1907.

[4] "Heredity in Relation to Eugenics." By Charles Benedict Davenport. Henry Holt & Company, New York, 1911.